THE ON-ROAD EXPERIENCES AND AWARENESS OF SLEEPINESS IN A SAMPLE OF AUSTRALIAN HIGHWAY DRIVERS: A ROADSIDE DRIVER SLEEPINESS STUDY

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ABSTRACT

Objective: Driver sleepiness contributes substantially to road crash incidents. Simulator and on-road studies clearly reveal an impairing effect from sleepiness on driving ability. However, the degree to which drivers appreciate the dangerousness of driving while sleepy is somewhat unclear. This study sought to determine drivers' on-road experiences of sleepiness, their prior sleep habits, and personal awareness of the signs of sleepiness.

Methods: Participants were a random selection of 92 drivers travelling on a major highway in the state of Queensland, Australia, who were stopped by police as part of routine drink driving operations. Participants completed a brief questionnaire that included demographic information, sleepy driving experiences (signs of sleepiness and on-road experiences of sleepiness), and prior sleep habits. A modified version of the Karolinska Sleepiness Scale (KSS) was used to assess subjective sleepiness in the 15 minutes prior to being stopped by police.

Results: Participants rating of subjective sleepiness were quite low, with 90% reporting being alert to extremely alert on the KSS. Participants were reasonably aware of the signs of sleepiness, with many signs of sleepiness associated with on-road experiences of sleepiness. Additionally, the number of hours spent driving was positively correlated with the drivers' level of sleep debt.

Conclusions: The results suggest the participants had moderate experience of driving while sleepy and many were aware of the signs of sleepiness. The relationship between driving long distances and increased sleep debt is a concern for road safety – increased education regarding the dangers of sleepy driving seems warranted.

Keywords: driver sleepiness, roadside survey, awareness of sleepiness, sleep habits, risky driving, Australian drivers

INTRODUCTION

Individuals who drive while experiencing acute sleepiness are at an increased risk of crashing. Driver sleepiness is recognised as a significant contributor to fatal and severe road crashes (Åkerstedt 2000; Connor et al. 2002; Horne and Reyner 1995). However, falling asleep behind the wheel is not the only way that sleepiness can influence crashing. The task of driving is a complex one that requires the successful operation and co-ordination of a number of psychological processes, including: perception, memory, motor control, decision making, and attention (Groeger 2002; Horswill and McKenna 2004; Spiers and Maguire 2007). Sleepiness has a detrimental effect on a number of these psychological processes (e.g., Åkerstedt et al. 2005; Campagne et al. 2004; Jackson et al. 2012; Killgore et al. 2006).

A number of studies suggest that drivers' risk perception of sleepy driving may be erroneous. For example, some studies suggest that sleepy driving is not acknowledged as a critical road safety issue when compared to other driving behaviours such as speeding or drink driving (e.g., Pennay 2008; Vanlaar et al. 2008). Yet, similar levels of performance decrement have been observed with modest sleep deprivation (20 hours of wakefulness) and blood alcohol intoxication levels of 0.1% (Williamson et al. 2001). Numerous studies suggest that long distance driving is a key risk factor for being involved in a sleep-related crash (e.g., Pennay 2008; Stutts et al. 2003). However, despite the well-known risks associated with long distance driving, many drivers will embark on such driving trips after incurring a substantial sleep debt (Philip et al. 1999). Last, survey data reveals that continuing to drive after noticing some signs of sleepiness is a common behaviour performed by drivers (Nordbakke and Sagberg 2007; Vanlaar et al. 2008) and highlights the erroneous risk perception of sleepy driving.

Another factor that has the potential to lead to risky driving is the driver's awareness of their sleepiness. Individuals that have limited knowledge of the physical (e.g., droopy eyelids, increased blinking) and psychological (e.g., wandering thoughts) signs of sleepiness are poorer at recognising increasing sleepiness (Kaplan et al. 2007). Moreover, some individuals underestimate their likelihood that they will fall asleep when experiencing high levels of sleepiness (Reyner and Horne 1998). Additionally, a sleepy driver's perception of their actual driving performance may be of little benefit as an indicator of impairment, as perception of driving performance is only weakly correlated with actual driving performance (Arnedt et al. 2000). Thus, self-perception of the signs of sleepiness is an important factor for drivers to make a decision about their level of sleepiness.

Determining drivers' awareness of the signs of sleepiness is essential in order to assess if educational campaigns are needed to further educate drivers. Several survey studies have examined drivers' awareness and experiences of driving when sleepy. However, the methodology used in these investigations has typically been self-report questionnaires that do not take place in the driving environment. The effects from recall bias could alter participants' responses (af Wåhlberg 2012; Coughlin 1990) and thus, responses could be substantially different between completing a questionnaire at home (for example) or from the roadside. Specifically, being in the road environment could facilitate greater recall of driving specific signs of sleepiness (e.g., variations in speed, changing position frequently) as opposed to common signs of sleepiness (e.g., yawing, frequent eye blinks). As such, the current study sought to examine the on-road experiences of sleepiness in a random sample of Queensland drivers. In total, four research questions were posed: (1) what are drivers' current on-road level of sleepiness? (2) what are the sleep habits of drivers before driving? (3) what are drivers' previous experiences and awareness of the signs of sleepiness? and (4) what symptoms of excessive daytime sleepiness are present in the sample?

METHOD

Participants and Location

Potential participants were a selection of passenger vehicles (i.e., no articulated vehicles or motorcycles were stopped during the data collection) stopped by Queensland police officers for the purpose of random breath testing (RBT) in the town of Miriam Vale. Miriam Vale is a small rural town (population 423: Australian Bureau of Statistics 2013) in the State of Queensland. Miriam Vale is located approximately 460 km north of the capital city of Brisbane - Brisbane and Miriam Vale are linked via the Bruce highway, which is the major costal highway of Queensland. The Bruce highway runs directly through the town of Miriam Vale and during the summer period a substantial proportion of the traffic is northbound holiday makers (Department of Transport and Main Roads 2013). The average age of all residents of Miriam Vale was 48 years (SD = 25.93) with 53.93% of residents being male. Overall, of all the eligible labour force residents of Miriam Vale 95.42% were employed (Australian Bureau of Statistics 2011). Passenger vehicles comprised the greatest proportion (59.87%) of registered vehicles in the region encompassing Miriam Vale, followed by light commercial and camper trailers (28.76%), motorcycles (8.33%), trucks (2.17%), articulated vehicles/prime movers (0.43%), and buses (0.44%) (Department of Transport and Main Roads 2014).

The authors were invited by the Queensland Police Service to conduct the study. Sleep-related crashes have been known to occur along the Bruce highway and in close proximity to the town of Miriam Vale. During 2010, the largest proportion of all the sleep-related crashes (33.33%) that occurred in the State of Queensland, was recorded in the region which encompasses Miriam Vale (Department of Transport and Main Roads 2012).The RBT site was set-up on the northbound traffic lane of the Bruce highway. The data was collected over two days during the month of December during 2011: the morning of Saturday the 10th (from 06:30-10:15) and the morning of Sunday the 12th (from 07:05-10:35). These dates were chosen to coincide with the end of the Queensland school year, which is a time of increased road traffic travelling on the Bruce highway due to the Christmas holiday period. The morning time period was chosen as previous research has shown that holidaymakers who set out driving early in the morning, typically have the greatest levels of sleep debts (e.g., Philip et al. 1999).

Materials

Participants completed a brief questionnaire that comprised demographic details (i.e., age, sex, employment status), driving characteristics (i.e., number of hours driven per week, duration of licensure), and experiences of sleepy driving (e.g., ever felt sleepy while driving, ever had a close call because of being sleepy, ever had a sleep-related crash, how often do you continue driving after noticing sleepiness). After examination of the relevant peer reviewed literature regarding signs of driver sleepiness (e.g., Kaplan et al. 2007; Nordbakke and Sagberg 2007), eight signs of driver sleepiness were utilised in the study. These signs of sleepiness included physical and psychological signs (e.g., yawning, changing position frequently frequent eye blinks, difficulty keeping eyes open, and a dreamlike state of consciousness) and signs of sleepiness associated with vehicle control (e.g., difficulty concentrating on driving, slower reaction to traffic events, and increased variation in speed). Participants responded to each item on a dichotomous scale (yes or no) whether they had ever felt any of these symptoms while driving.

Aspects of the questionnaire that focused on sleep health included recent sleep patterns (e.g., number of hours slept in the last 24 hours, what is your habitual sleep duration) and perceptions of sleep quality (e.g., do you have any difficulties getting to sleep). The study also sought to examine the participants' levels of excessive daytime sleepiness via the Epworth Sleepiness Scale (see below) and symptoms of a sleep-related breathing disorder. Regularly snoring, stopping breathing, and feeling tired even after a full night of sleep are three common symptoms of a sleep-related breathing disorder (Chung et al. 2008) and participants were assessed about whether they had any of these symptoms.

Two established scales were also included in the questionnaire; the Epworth Sleepiness Scale (ESS: Johns 1991) and the Karolinska Sleepiness Scale (KSS: Åkerstedt and Gillberg 1990). The ESS is a self-report measure of excessive daytime sleepiness. Participants must rate the likelihood of dozing or falling asleep during the last month in eight different situations via a four-point Likert scale (i.e., 0-4). The responses to the eight items are then summated (range: 0-24) to generate a total score with higher scores indicative of greater daytime sleepiness. The ESS has adequate reliability and validity as a measure of excessive daytime sleepiness (Johns 1991). The KSS is a self-report measure of the individual's current level of subjective sleepiness (i.e., state sleepiness). The KSS is a nine-point Likert scale with higher scores indicative of higher levels of subjective sleepiness. The KSS is a reliable and valid measure of subjective sleepiness, when compared with objective physiological measures (Kaida et al. 2006). The scale was modified to assess the level of participant's sleepiness during the 15 minutes of driving prior to completing the questionnaire. A custom designed current alertness levels scale was developed and utilised in the study to assess the participants' alertness levels while completing the survey. The participants' current alertness levels were assessed on a 10-point Likert scale scored from 1 (tired) to 10 (fresh).

Procedure

Passenger vehicles were randomly stopped by police as per standard RBT operating procedures (Queensland Police Service 2014). Drivers were requested to provide a breath sample and those drivers who returned a negative reading were free to continue with their journey. Before the driver left the RBT site, the officer informed the driver of the research project and the driver was directed to drive to a parking area at the side of the road if they wanted to participate. Those drivers who agreed to participate were approached by the University researcher when they reached the designated parking area. The researcher provided information about the project as well information regarding as confidentiality and anonymity of responses, and confirmed if the driver would still like to participate. Once verbal consent was received, drivers completed the questionnaire, placed their responses into a sealed envelope, and handed it back to the researcher before continuing on their journey.

Statistical Analyses

Descriptive statistics included the presentation of mean scores with standard deviation and percentages of participants where appropriate. Non-parametric statistical analyses were used as the data had some slight departures from normality. As such, the degree of association between two continuous variables utilised Spearman's Rho correlation coefficient and Phi correlation coefficient between two dichotomous variables. The statistical difference between two independent groups utilised the Wilcoxon rank-sum test.

RESULTS

Sample and Driving Characteristics

Over the two days, 529 random breath tests were conducted on drivers travelling on the northbound section of highway. In total, 92 participants choose to take part in the current study – representing a response rate of 17.39%. The majority of participants were male (65.93%). The average age was 47 years (*SD* = 14.68; range = 17-75). Most participants were employed (88.24%) and worked daytime hours (58.82%) or rotating daytime shift (3.53%). A small proportion worked rotating shifts with nights (5.88%) or permanent nightshift (2.35%). The remainder of the sample were unemployed (2.35%) or retired (9.41%).

The average duration of licensure was 28.66 years (*SD* = 15.61) with a range of 1-57 years. The majority of participants drove 10 hours or less per week (53.66%), with the remaining driving between 11-20 hours (25.61%), 21-30 hours (7.32%), or greater than 30 hours per week (13.41%). Over half of the participants (51.22%) drove 20, 000 or less kilometres per year. The next largest (20.73%) proportion drove between 20, 000-30, 000, with approximately a quarter of participants (28.05%) driving greater than 30, 000 kilometres per year.

Sleepy Driving

On-road levels of sleepiness: No participant reported having fallen asleep during the driving trip prior to completing the survey. The participants mean KSS for the 15 minutes of driving prior to being stopped was *M* = 2.19, *SD* = 1.36. The majority of participants (over 90%) rated their subjective sleepiness between 1 (extremely alert) and 3 (alert) on the KSS. At the time of completing the questionnaire participants reported a high level of alertness (*M* = 8.58, *SD* = 1.22), on a scale of 1-10 with higher scores indicating higher alertness. Considered together, these data suggest that most participants were not experiencing acute levels of sleepiness. The average duration of driving prior to participation was approximately two hours (*M* = 2.12, *SD* = 1.36); however, there was a considerably large amount of variability, as indicated with a range of 20 minutes to 10 hours.

Recent Sleep Habits: Overall, 71.74% of the sample reported their sleep quality was “good” or “excellent”, 26.10% of the sample reported “average” sleep quality, with 2.16% reporting “poor” sleep quality. In the preceding 24 hours participants reported sleeping on average seven and a half hours (*M* = 453.13 mins, *SD* = 104.62) with a range of 0-660 minutes. In terms of the habitual sleep duration the participants averaged seven and three quarters hours (*M* = 465.82, *SD* = 59.89, range = 240-600 mins). Figure 1 displays the duration of sleep the participants obtained in the preceding 24 hours (black bars) and habitual sleep duration (white bars). These data suggest many participants did not achieve their habitual duration of sleep in the preceding 24 hours. Such that, the amount of sleep in the preceding 24 hours prior to the study was not significantly correlated with habitual sleep duration, $r_{\text{rho}} = .16$, $p = .14$. This disparity suggests that an amount of sleep debt (or surplus) may have been present in the participants.

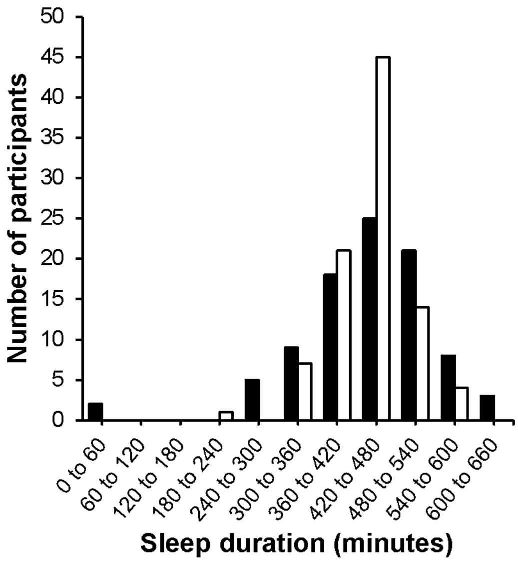

Figure 1. Duration of sleep obtained in the preceding 24 hours (black bars) and habitual sleep duration (white bars).

The participants' sleep debt-surplus was examined. This was calculated by subtracting the reported duration of sleep obtained in the preceding 24 hours period from habitual sleep duration; thus, negative values indicate a debt. Overall, the mean level of sleep debt-surplus was -13.19 minutes (*SD* = 114.54). However, there was a considerable amount of variability as indicated with a range of 240 minutes (a surplus) to -480 minutes (a debt). Overall, two-fifths of participants (40.66%) had some level of a sleep debt, which ranged from 10 to 480 minutes. Almost one-fifth (18.69%) of participants reported a sleep debt greater than 120 minutes, with 9.89% of participants reporting a debt greater than 80 minutes. Figure 2 displays the distribution of participants with a sleep debt-surplus.

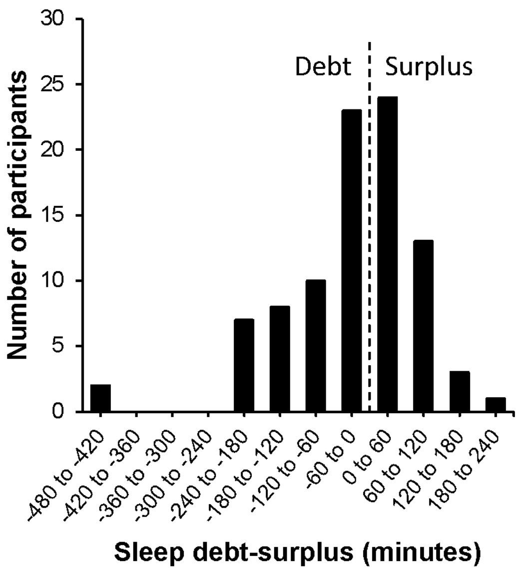

Figure 2. Distribution of participants with a sleep debt-surplus (negative values indicate a debt).

The associations between driving duration, sleep debt-surplus, KSS, current alertness, and ESS were examined. Table 1 displays the correlations between driving duration, sleep debt-surplus, KSS, current alertness, and ESS. The negative correlation between the driving duration and sleep debt-surplus indicates drivers who had driven for longer durations reported higher levels of sleep debt. Current alertness was negatively correlated with the driving duration, level of sleep debt-surplus, and KSS – all of which were in the expected direction of association. A large correlation was observed between KSS and the current alertness variable. No correlations were observed with the ESS and any of the other variables.

Table 1. Spearman rho correlation coefficients between driving duration, sleep debt-surplus, KSS, current alertness, and ESS

Variable	1.	2.	3.	4.	5.
1. Driving duration	-				
2. Sleep debt-surplus	.38**	-			
3. KSS	.18†	.14	-		
4. Current Alertness	-.30**	-.33**	-.66**	-	
5. ESS	-.07	.01	.13	-.07	-

* < .05, ** < .01, † < .10
Note: Sleep debt-surplus, negative values indicate a debt. Higher scores for the KSS, current alertness, and ESS variables indicate greater sleepiness or alertness respectively.

Experiences and awareness of signs of sleepiness: The third research question was concerned with examining the participants' experiences and awareness of sleepiness. Approximately, two-thirds (69.57%) of participants reported having experienced sleepiness while driving in the past, while 26.37% reported having a 'close call' because of sleepiness. Only three participants (3.33%) reported having being involved in a sleep-related crash. Overall, participants reported a low frequency of continuing to drive while sleepy (M = 3.29; SD = 2.37) as rated on a 10-point Likert scale with higher scores indicating greater sleep driving.

The proportion of participants ever having experienced a sign of sleepiness when driving, as well as the relationships between experiencing that sign of sleepiness and the two on-road behaviours can be found in Table 2. Overall, five of the eight signs of sleepiness were correlated with having ever felt sleepy when driving; this included some early signs of sleepiness (e.g., yawning, changing position frequently) and some of the more extreme signs of sleepiness (e.g., difficulty concentrating on driving, difficulty keeping eyes open). The on-road driving behaviour of having a close call when sleepy was correlated with three signs of sleepiness, those being difficulty concentrating on driving, difficulty keeping eyes open, and variations in speed. Difficulty concentrating on driving, difficulty keeping eyes open, and variations in speed signs of sleepiness were correlated with both on-road driving behaviours; however, the magnitude increased from ever felt sleepy when driving to having a close call when sleepy.

Table 2. Phi correlation coefficients between the signs of sleepiness and on-road experiences of sleepiness

Signs of sleepiness	Percentage nominated	On-road experiences: Felt sleepy when driving (yes)	On-road experiences: Close call when sleepy (yes)
Yawning (yes)	79.35%	.19*	.12
Changing position frequently (yes)	54.35%	.39**	.06
Frequent eye blinks (yes)	40.22%	.21	.14
Difficulty concentrating on driving (yes)	30.43%	.25*	.34**
Difficulty keeping eyes open (yes)	22.83%	.22*	.37**
Dreamlike state of consciousness (yes)	15.22%	.05	.15
Variations in speed (yes)	15.22%	.27*	.29**
Slower reaction to traffic events (yes)	14.13%	.11	.17

* < .05, ** < .01

Excessive Daytime Sleepiness

The participants' level of excessive daytime sleepiness was examined. Regarding difficulties falling asleep, approximately one-third of participants (33.70%) reported having mild problems with falling asleep at night. Approximately, two-fifths of the sample (41.76%) reported they regularly snore and three-fifths of the sample (58.70%) reported sometimes or frequently feeling daytime sleepiness after a full night sleep. The proportion of the sample that had been told they stop breathing when asleep was 14.13%.

The Epworth Sleepiness Score of the sample (M = 5.71, SD = 4.28) was below the cut-off of >10 that indicates problematic daytime sleepiness (Johns 1991). Nonetheless, 11.49% of participants reported an ESS of greater than 10. Overall, 9.78% of the sample reported having three of the most common symptoms of a sleep-related breathing disorder (i.e., snoring, feeling sleepy after a full night sleep, and stopping breathing when asleep). The ESS scores between participants who responded positively to the three potential symptoms of a sleep-related breathing disorder (M = 7.11, SD = 5.44) was not significantly different to those who did not report these symptoms (M = 5.55, SD = 4.14), Z = -0.67, p = .51.

DISCUSSION

The aim of the current study was to examine the on-road experiences of sleepiness in a sample of Queensland drivers. The levels of on-road sleepiness that were reported by the participants were quite low. That is, over 90% of participants rated their sleepiness level during the 15 minutes of driving just prior to being pulled over between extremely alert and alert on the KSS. A low level of sleepiness would be expected when considering normal circadian functioning, where sleepiness is at its lowest during the morning (Borbely 1982; Folkard and Åkerstedt 1991). The current results are in accordance with normal circadian functioning. Additionally, similar levels of subjective sleepiness have been reported by non-shift working drivers, who were also interviewed at the roadside between the morning hours of 08:00-10:00 (Di Milia 2006). Nonetheless, a number of factors can affect sleepiness levels.

A factor that could have reduced participant's sleepiness levels was the arousing effects of driving into a town. Previous research suggests the scenery a driver views can affect sleepiness levels – with more dynamic and stimulating scenes facilitating lower levels of sleepiness (Baulk et al. 2001; Thiffault and Bergeron 2003). In addition, situations involving social interactions have also been shown to reduce subjective sleepiness levels (Åkerstedt et al. 2008; Oron-Gilad et al. 2008). As such, driving into town may and interacting with the police and then the researcher might have provided an increased level of stimulation for the participants in this study and thus accounted for the low levels of subjective sleepiness. This, increased level of stimulation could also explain the lack of association between the KSS and ESS. The majority of the items of the ESS are situations that involve reduced stimulation (e.g., sitting and reading, lying down to rest in the afternoon when circumstances permit). Additionally, the ESS assess the chances of dozing during certain situations in the last month (Johns 1991), whereas, the modified KSS used in the current study assessed the participants' sleepiness in the preceding 15 minutes.

The sleep habits of the participants prior to driving are a potential road safety concern. Almost a quarter of participants reported a sleep debt of 120 minutes. Insufficient sleep is a major factor associated with an increased risk of having a sleep-related crash (Fell and Black 1997; Stutts et al. 2003). Additionally, drivers who reported the largest sleep debts were also driving for the longest durations. This finding is particularly concerning as previous research has shown that sleep-related crashes are more prevalent with long distance driving (Sagberg, 1999) as well as considering that moderate amounts of sleep restriction can impair performance levels in driving simulators (Akerstedt et al. 2010). Previous research examining the sleep and driving habits of French drivers has also shown that a large proportion of drivers do not achieve their habitual sleep duration prior to setting out on a long distance drive (Philip et al. 1999). Driver sleepiness educational campaigns highlight the dangers of not getting a full night sleep the night before a drive, especially a long distance drive. Subsequently, a survey of Australian drivers regarding the causes of driver sleepiness revealed that the most frequent factor for developing sleepiness while driving was not getting a "good night's sleep" (Pennay 2008). Considered together, the behaviours of the drivers in the current study are particularly concerning. It is possible that the risk perception of sleepy driving for these drivers could be erroneous and could have influenced their decision to engage in a risky driving behaviour.

The experiences and awareness of signs of sleepiness of the current study participants were somewhat consistent with the extant literature. Approximately 70% of participants had experienced sleepiness while driving in the past. This findings is consistent with previously work (Armstrong et al. 2010; Vanlaar et al. 2008). The prevalence of close calls reported in the current study was 26.37%, which is also consistent with previous research. For instance, Powell et al. (2007) found 18.40% of their sample had experienced a near miss due to sleepiness. However, prevalence rates from other investigations have varied between 8.50-19.10% (Armstrong et al. 2013; Quera Salva et al. 2014). The greater prevalence found in the current study might be due to the rural location the study. Rural locations are known to have a greater relative risk for having a fatal crash when compared to urbanised regions (Siskind et al. 2011) and have also been associated with higher levels of sleep-related crash risk (Cummings et al. 2001). Therefore the higher prevalence of close calls found in the current study might be due to differences between rural and urban locations.

The current study found many of the signs of sleepiness the drivers had experienced were associated with previous on-road behaviours. Moreover, a pattern was observed with the relationships between the signs of sleepiness and particular on-road experiences. Specifically, the early signs of sleepiness (e.g., yawning, changing position frequently) and some of the more extreme signs of sleepiness (e.g., difficulty concentrating on driving, difficulty keeping eyes open) were associated with having ever felt sleepy while driving. However, having a close call when sleepy was only associated with the heavy signs of sleepiness and the magnitude of the associations was larger. Simulator studies suggest that having a close call generally occurs when sleepiness is very high (Campagne et al. 2004; Reyner and Horne 1998). Difficulty concentrating on driving, difficulty keeping eyes open, and variations in speed have all been found to correlate with EEG defined signals of sleepiness such as theta and alpha bursts (Campagne et al. 2004; Howard et al. 2014). Educational campaigns could seek to convey to drivers, that they should being aware of the gradual accumulation of the signs of sleepiness when driving, as increases in the number of signs of sleepiness is related to greater cognitive and performance impairment (Kaplan et al. 2007; Kribbs and Dinges 1994). Educating drivers to be aware of specific signs of sleepiness (e.g., microsleeps) might be too restrictive, and as suggested by Kribbs and Dinges (1994) experiencing a microsleep is well past the point of impairment from sleepiness. These considerations could be important for future educational campaigns.

While the current results are useful regarding the experiences and awareness of sleepiness, some limitations need to be considered. First and foremost, due to the nature of the study design and data collection method the obtained results are susceptible to social desirability, recall, and self-selection biases. Second, the sample size and sample characteristics are not representative of Queensland drivers and therefore needs to be replicated with a larger sample. Last, only the most basic information was collected from the questionnaire. While a more thorough questionnaire might have provided more in-depth data, the constraints of collecting data at an RBT site necessitated a brief questionnaire. Future research could seek to improve upon these limitations. In addition, future research could seek to collect roadside data at different times of the day (e.g., morning, afternoon, night-time) to better understand the gradual increases of sleepiness associated with normal circadian functioning. The utility of on-road surveys appears promising. That is, even though the majority of participants did not report high levels of sleepiness while driving, the study did reveal that a number of drivers had incurred a substantial sleep debt from the previous night's sleep. Future on-road surveys might also seek to assess drivers' risk perception of sleepy driving and how this might contribute to risky driving behaviours.

The current study sought to determine what are drivers' on-road experiences of sleepiness and their awareness of the signs of sleepiness. The participants' subjective sleepiness levels when participating in the study were relatively low and were not indicative of risky driving. Yet, the majority of participants reported having driven while sleepy in the past and approximately a quarter had a close call while driving in the past which suggests some level of risky driving. Moreover, the relationship between sleep habits and the duration of driving were also concerning; with individuals who reported having a sleep debt were actually driving the longest distances. The participants reported having previously experienced a number of the signs of sleepiness while driving in the past. Last, the obtained data suggests that excessive daytime sleepiness could be an issue for a small proportion of Queensland drivers.

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